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LinCom CORPORATION

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June 28, 1995

Mr. William F. Caton
Acting Secretary
Federal Communications Commission
1919 M Street N.W.
Washington, DC 20554

Re: CC Docket No. 92-297, RM-7872, RM 7722
Ex Parte Presentation

Dear Mr. Caton:

Enclosed for filing with the Commission in this docket are five copies of a report prepared by LinCom Corporation entitled, "Review of GeoWave Proposal for the Co-Frequency Sharing of the 28 GHz Band by the Local Multipoint Distribution Service (LMDS) and the Fixed Satellite Service (FSS)." This report was prepared under contract to Teledesic Corporation.

The enclosed LinCom report demonstrates that the May 9, 1995 GeoWave proposal for the Co-Frequency sharing of the 28 GHz band between the local multipoint distribution service (LMDS) and the fixed satellite service (FSS) is simplistic and flawed. The GeoWave proposal neglects to take into consideration several factors, most important of which is the effect of adjacent cell interference into LMDS subscribers.

In conclusion, as demonstrated herein the GeoWave proposed solution does not work.

Copies of this letter and the enclosed LinCom report are being provided simultaneously to those individuals identified below.

Respectfully submitted by:

by: Wm C. Lindsey

Dr. William C. Lindsey, Chairman of the Board
LinCom Corporation

No. of Copies rec'd 0+4
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Review of GeoWave Proposal for the Co-Frequency Sharing of the 28 GHz Band by the Local Multipoint Distribution Service (LMDS) and the Fixed Satellite Service (FSS)

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LinCom Corporation

June 27, 1995

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Summary

This report reviews a proposal made by GeoWave Corporation for the co-frequency sharing of the 28 GHz band between the LMDS and the FSS services. The proposal suggests that in order to prevent interference from the FSS uplinks into the LMDS subscribers, the LMDS systems located in an FSS ground cell that is illuminated by the satellite hopping spot beam antenna be temporarily de-activated. The LMDS systems will resume operation as soon as the hopping spot beam moves to other FSS ground cells.

This report will demonstrate that the GeoWave proposal is simplistic and flawed. It neglects to take into consideration several factors, most important of which is the effect of adjacent cell interference into LMDS subscribers. Detailed analysis submitted by Teledesic Corporation to the FCC Negotiated Rule Making Committee (NRMC) in 1994, clearly demonstrated that the interference from active FSS uplinks in a particular ground FSS cell extend well beyond the boundary of that cell.

GeoWave Proposal

On May 9, 1995, GeoWave Corporation presented a proposal for the co-frequency sharing of the 28 GHz band between the LMDS and the FSS. A very brief overview of this proposal was given to LinCom Corporation for review.

GeoWave used the Teledesic satellite system as a representative of the FSS providers and CellularVision as a representative of LMDS providers. The Teledesic satellite system utilizes a hopping spot beam antenna to sequentially illuminate different cells on the earth's surface. The Teledesic system maps the earth surface into a fixed grid of "supercells", each consisting of nine cells. Each cell within a supercell is assigned to one of nine equal time slots on a time division basis. All communications takes place between the satellite and the terminals in that cell during its assigned time slot. The cells are scanned periodically by the satellite's transmit and receive beams, resulting in TDMA among the cells in a supercell. LMDS cells are distributed within the Teledesic cells (There are roughly 18 three miles radius LMDS cells in a Teledesic cell).

When a Teledesic cell is illuminated, the interference caused by all active TSTs in that cell will cause an unacceptable degradation in the quality of the LMDS video channels received by the LMDS subscribers. To prevent this interference, GeoWave proposes the following : during the time that a Teledesic cell is illuminated (roughly 3 msec), all LMDS systems within that cell shall be de-activated, whereas all LMDS systems in any of the remaining 8 idle cells shall be operational, i.e. the LMDS systems can use the spectrum 89% of the time without interference to and from the Teledesic satellite system.

Flaws in GeoWave Proposal :

The GeoWave proposal is a simplistic and flawed approach to solve a rather complicated co-frequency sharing problem. It omits several facts which, if taken into consideration, would invalidate the utility of the proposal. These flaws can be summarized as follows:

1. GeoWave completely neglects the effect of adjacent cell interference. A detailed analysis submitted by Teledesic Corporation to the NRMC in 1994, clearly indicated that the transmission from TSTs located in an illuminated Teledesic cell will cause interference to LMDS subscribers located in adjacent cells.

   In Figure 1, an LMDS subscriber is placed on the edge of the LMDS cell and is pointing toward the center of the cell where the LMDS hub is located. The enclosed area which includes the antenna boresights between the subscriber and the hub indicate the region where a TST can not operate without causing the carrier to interference ratio (C/I) at the LMDS subscriber to dip below the minimum acceptable value. It was shown in [1] that the minimum clearance distance, measured from the boresight, is 38.1 km (23.7 miles).

   In Figure 2, five LMDS subscribers were located at random on the edge of an LMDS cell located at the center of a Teledesic cell. The TSTs can not be located in the shaded areas without causing an unacceptable interference into those LMDS subscribers. As the number of LMDS subscribers located at the edge of that LMDS cell increases, the shaded areas would increase and a circle of radius 38.1 km, centered around the LMDS hub, would result, in which TSTs can not be located. This is referred to as the "potential interference zone" in Figure 2.

   In Figure 3, four LMDS cells are located near the boundaries of a Teledesic cell. It is clear that the potential interference zones extend beyond the boundaries of that particular Teledesic cell. For example, during the time Teledesic cell number 6 is illuminated, some TSTs located in that cell will cause an unacceptable interference into the LMDS subscribers that are located in some LMDS cells in Teledesic cell number 9. Hence, the statement made by GeoWave Corporation that LMDS systems will be operating in an interference-free environment 89% (=8/9) of the time is completely invalid.

2. The GeoWave proposal neglects the fact (although this fact is clearly demonstrated in slide 7 of their presentation) that an LMDS cell might overlap with as many as four adjacent Teledesic cells as shown in Figure 4. In that case, those LMDS cells will be de-activated 44.4% of the time (=4/9) rather than just 11.1% (=1/9) of the time as GeoWave claims. The LMDS

utilizes an omni-directional antenna at their hub, so deactivating an LMDS cell means that all LMDS subscribers in that cell will be denied service.

3. Their statement in slide 3 that the minimum distance between the TST and the analog LMDS subscriber must be agreed upon, does not address the significant interference problem. The analysis presented to the NRMC by Teledesic Corporation clearly demonstrated that the required separations are not acceptable or practical.

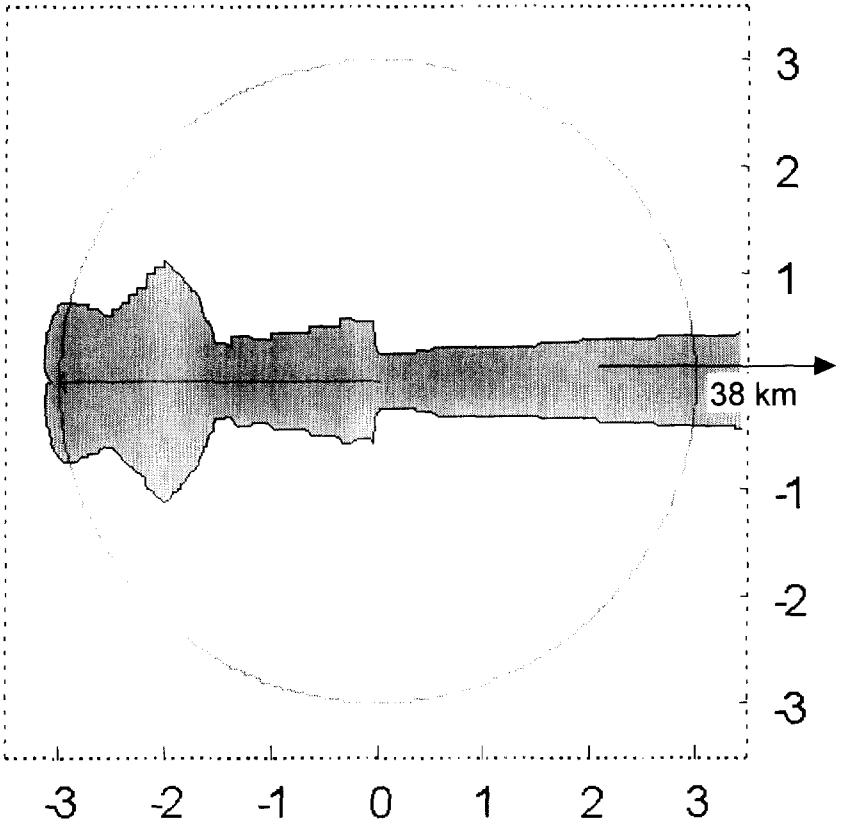
4. With regard to slide 5, the time synchronization of digital LMDS transmissions with the duty cycle of the FSS uplink transmission was also mentioned in a recent Bellcore report as a possible mitigation option. The GeoWave presentation uses the same argument and claims that it is a simple and an inexpensive task to achieve time synchronization. Time synchronization will be difficult to achieve especially since the propagation delay will vary with the path length and the satellite transmissions need to be timed accurately to manage this activation-deactivation process. Also, if the LMDS systems employ back channels for their subscriber-to-hub traffic, each individual subscriber needs to time synchronize its transmitter with the Teledesic satellite system if GeoWave proposal of activation and deactivation procedure is implemented. This is a rather costly task especially for the cost-conscience LMDS service provider trying to compete with cable providers.

Conclusions :

The GeoWave proposal for the co-sharing of the 28 GHz band between the LMDS and the FSS is simplistic and flawed. The proposal illustrates GeoWave's lack of understanding of how the FSS and the LMDS systems operate. GeoWave does not present any analysis to substantiate it's claims. In fact, a quick reference to the NRMC report would demonstrate that its proposed solution does not work.

References:

[1] Final Report to the Negotiated Rule Making Committee from Working Group 1 (FSS & LMDS), September 22, 1994



	Clear Sky
Boresight min. Clearance (mile)	23.7
Sidelobe (45°) min. Clearance (mile)	1.50
Backlobe min. Clearance (mile)	0.0751

Figure 1 Interference from TST into LMDS hub to subscriber link. The LMDS subscriber is located at cell edge pointing to the hub at cell center. The subscriber will experience unacceptable interference if a single TST is operating in the shaded area.

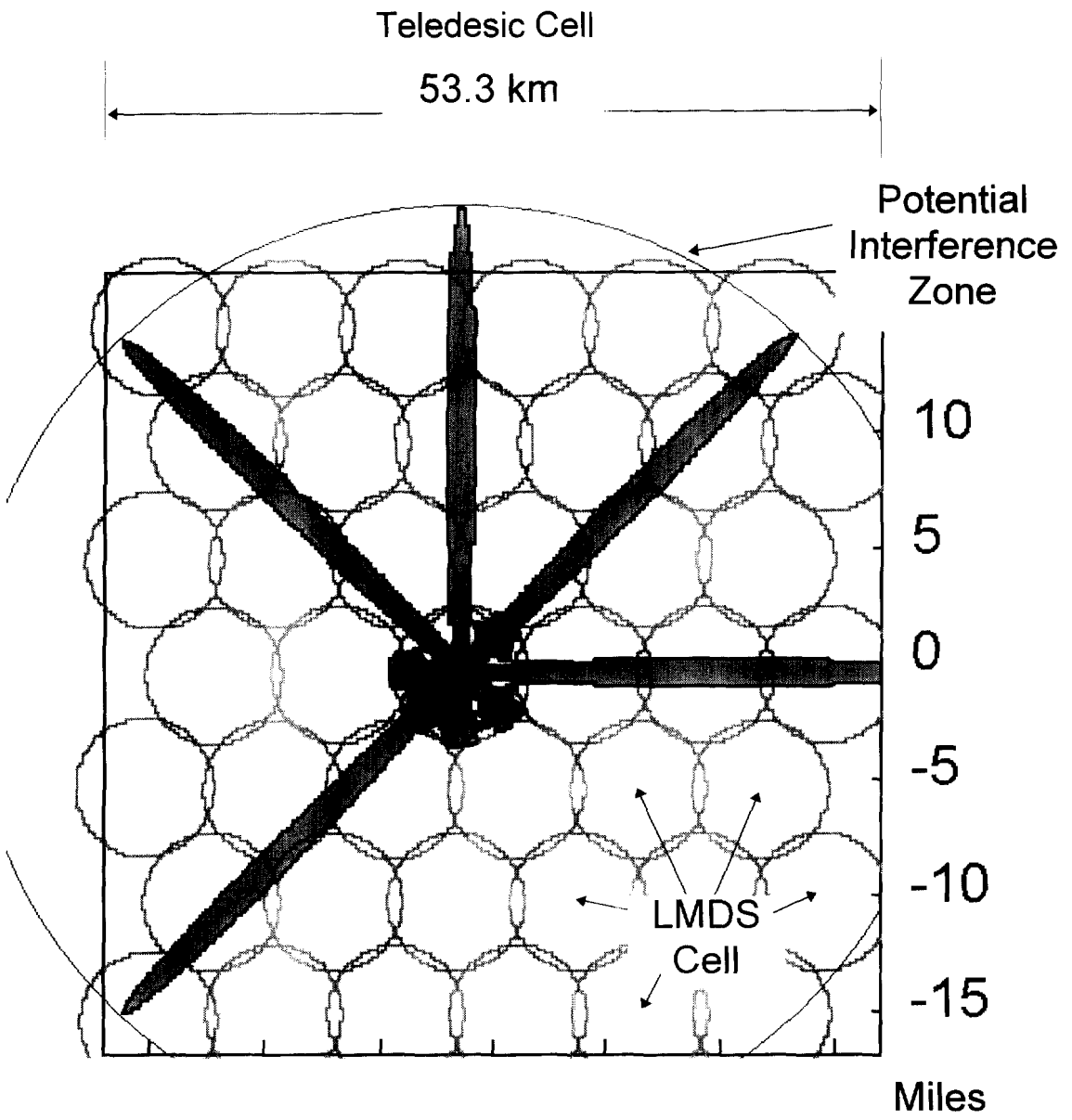


Figure 2 Interference from TST into LMDS hub to subscriber link. The potential interference zone indicates that a TST may interfere with LMDS subscribers in more than 4 LMDS cells. An LMDS subscriber may experience unacceptable interference even if a TST is 38 km away.

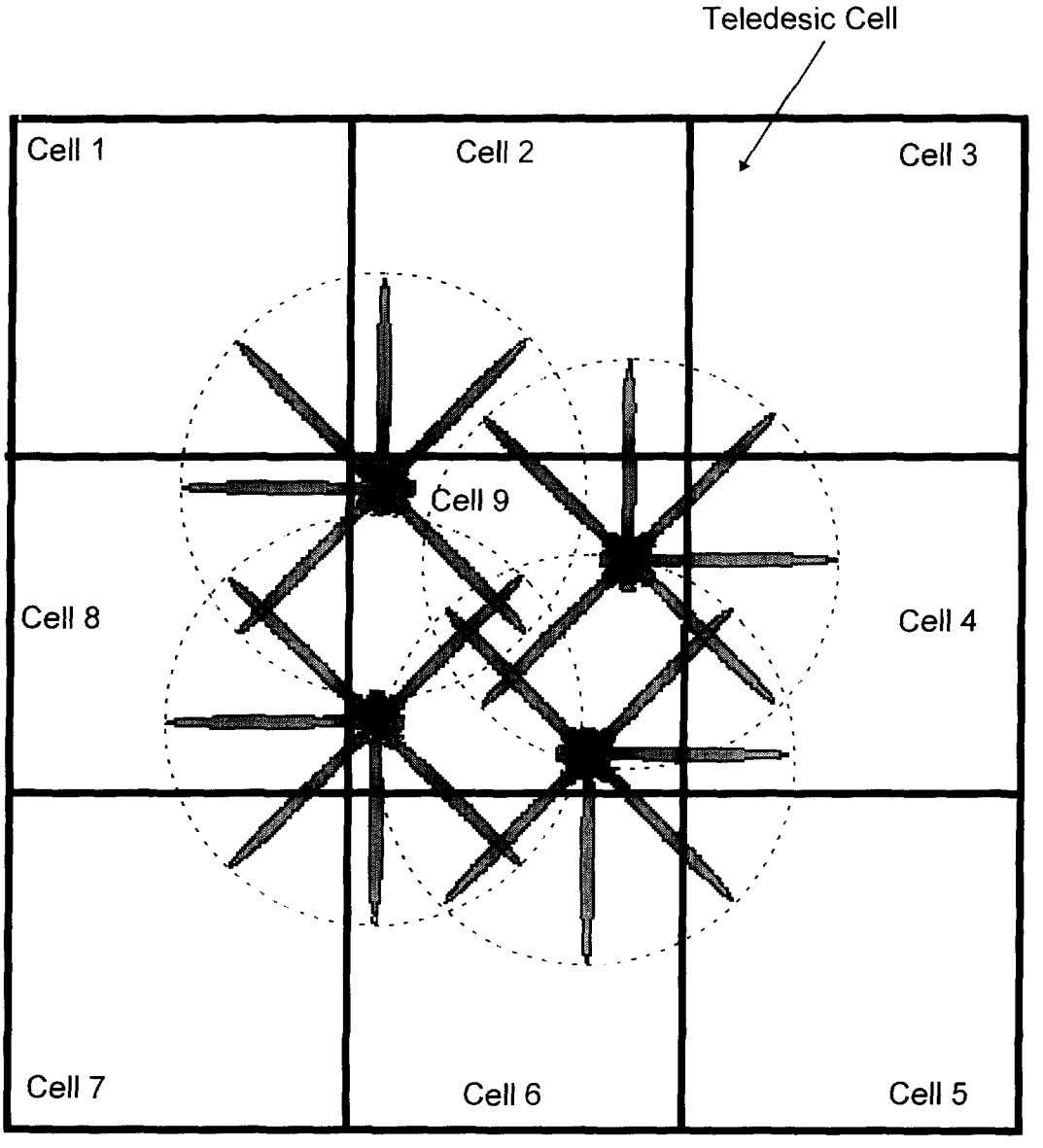


Figure 3 The Potential interference zones is a circle with a radius about 38 km. Any TSTs located within Teledesic cell 1 through cell 9 may interfere with LMDS subscribers located in cell 9.

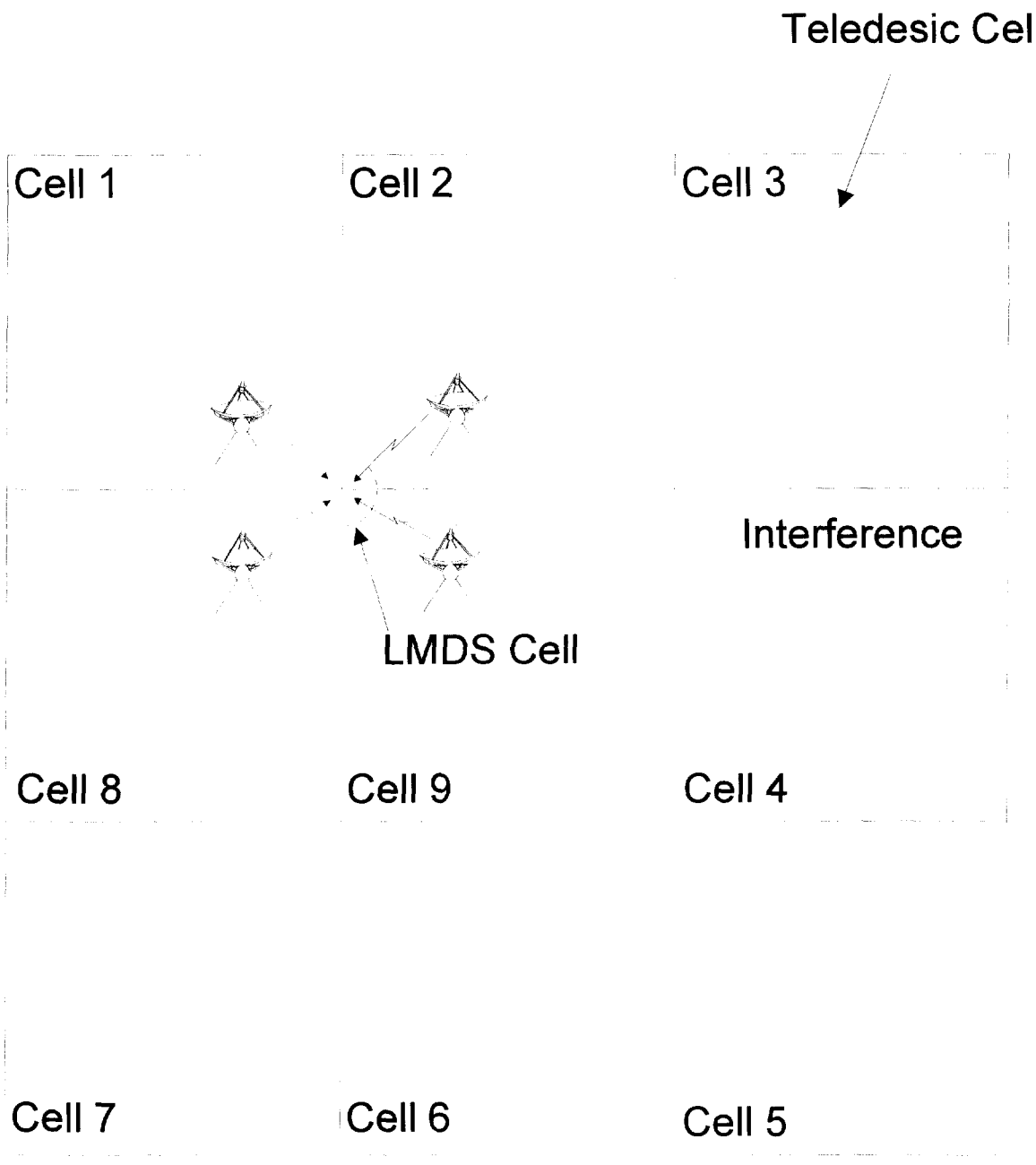


Figure 4: Possible Interference Components on an LMDS Cell Located at the Border of 4 Teledesic Cells